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BUREAU OF ENTOMOLOGY

FOREST INSECT INVESTIGATIONS

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MEMORANDUM OF INSECT DAMAGE ON PARADISE CREEK

SEQUOIA NATIONAL PARK, CALIFORNIA

by

GEORGE R. STRUBLE
Bureau of Entomology

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MEMORANDUM OF INSECT DAMAGE ON PARADISE CREEK, SEQUOIA NATIONAL PARK

Introduction

A recent outbreak of insects which killed a large number of trees in the Paradise Creek basin of Sequoia National Park caused considerable concern to park officials. At the request of the park superintendent this area was examined by J.M. Miller of the Bureau of Entomology during the latter part of March, 1930, and he considered the infestation serious enough to warrant control measures. Further investigations were made April 8-10, 1930, by Person and Struble of the Bureau of Entomology at the time the infested trees were being felled and treated by the Park Service.

The main infestation was found to be concentrated in a small area along the north and west slopes rising above Paradise Creek, and about one-half mile from the point where the creek flows into the Kaweah River. Recently faded trees were also noted along the crest of the ridge to the south.

Investigations were carried on by felling a number of representative infested trees and carefully examining them from the base to the top. Individual tree records were made for each tree cut, and stem analyses were carefully taken. The kind assistance of Mr. Been, park naturalist, and several of the park rangers is acknowledged.

Description of Area

The slopes bounding each side of Paradise Creek are very steep, and as a result much of the moisture precipitated by rain and snow is readily drained off. This factor undoubtedly affects the condition of the stand, especially during drought years. The creek flows from the base of the ridge to the south, directly north to the Kaweah River. This forms a basin with slopes facing east and west, except where occasional turns to the east create slopes facing north or south. The heaviest yellow pine stands are found near the junction of Paradise Creek with the Kaweah River, and extend back about one mile. The pines extend well up on the north and east slopes and not so much on the west slopes. This basin is not a typical yellow pine site, but is more representative of the oak-brush type of the foothill regions. The elevation of the area studied varies, approximately from 3,000 to 4,000 feet. This area is shut in with high ridges on all sides, and there is consequently poor air circulation, which probably results in higher temperatures than would normally occur at this elevation.

Condition of Yellow Pine

General

Three types of injury were at once apparent upon making a general ocular survey of this area. Top-killed trees greatly outnumbered the other two types, trees entirely killed were fairly abundant, and trees with dead lateral branches, twigs and needles were scattered here and there. Although the largest proportion of the stand was found to be in the thrifty and co-dominant classes, it was nevertheless attacked by several species of insects which are associated with a general run-down condition caused by drought or poor site conditions.

Growth Rate

The growth rate of trees from 1910 to 1929 is shown by the curve in Fig. 1, which is based on 11 green trees representative of the area. This curve shows that previous to 1924 the growth was good, and that following the exceptionally dry year of 1924 and subsequent dry years up to and including 1929 a very decided drop in growth took place. This is now reflected in the condition of the stand.

Fig. 2 gives a comparison of growth rates from 1921 to 1929 for trees which were killed during 1929 and for selected fast and slow-growing trees which are fairly representative of the area. The average growth for the fast- and slow-growing green trees is also shown. This curve is somewhat higher than the growth curve of the insect-killed trees. The slow-growing green trees, on the other hand, show a much slower growth than the trees killed by insects, except during the years 1928 and 1929.

The curve showing the growth rate of trees killed by insects in 1929 follows the same course as the green trees up to the year 1926. That year showed an increase instead of a decrease in increment. Again, in the years 1928 and 1929 the increment put on was opposite that of the green trees; that is, a decrease in growth was shown for 1928 and an increase for 1929. These facts can be explained only by the presence of old buprestid work, which was noted on several of the insect-killed trees and which undoubtedly interfered with the normal rate of growth. The trees, being weakened, finally succumbed to insects in the fall of 1929 and winter of 1930.

Insect Damage

The amount of infestation, insect species responsible and distribution of infesting insects on the stems of different trees were determined by felling 13 representative trees and examining the entire length of the trunk. Seven species of insects were found to be quite common, three of which were doing considerable damage. These are taken up in the order of their importance.

1. Dendroctonus brevicomis Lec. Trees which were entirely killed showed a large percentage of the bole infested with the western pine beetle. This insect is responsible for a large part of the damage to trees in this vicinity. Heavy broods were found in the large-larval, pupal and adult stages. Not only is this insect the most important at the present time, but it has also been of great importance in past years, as evidenced by the number of snags scattered over the area.

2. Buprestids. Contrary to what is usually expected--viz., that top-killed trees are largely the result of Ips--the trees top-killed in this area were for the most part killed by buprestids. This is probably due to the low resistance of the stand following successive poor growth years. Buprestids were found not only in the tops but also in the main trunk, some of the trees being infested with them for very nearly the entire length. The stage of brood at this time was found to be larvae, which were one-half to fully mature.

3. Ips confusus. The records of infestation taken on trees cut showed that the percentage of bole infested by this species was less than either of the other two insects discussed, but it was also noted that this species was very active at this time. On a tree felled only two days prior to the examination there were found many fresh attacks and beetles entering egg galleries.

4. Dendroctonus monticolae. The proportion of bole infested by this species was small enough to be of secondary importance. Only patches scattered here and there contained old work of D. monticolae, and in a few instances broods of fully-developed larvae and pupae were found.

5. Dendroctonus valens. In the only two trees completely infested for their entire length, this species was found in the base of the stump extending up to two or three feet. It is not important, however, as infestations occur only where the tree is beyond recovery. Full-grown larvae represented the only stage of brood found.

6. Other Insects. As previously mentioned, some of the trees were noted to have a "dying" appearance by the admixture of dead twigs and needles scattered throughout the crown. Two trees felled, with this condition evident, were carefully examined and the cause was found to be due to two insects. (a) A species of Ityophthorus was mining out the inner bark of the twigs, and the resultant girdling had killed many of them. Only occasional adults could be found at this time and no brood was evident; (b) scale insects were found on the needles and were apparently doing much damage, as evidenced by the yellowish color. Xanthotetus pini was outstanding, and in a very few instances Chionaspis pinifoliae was present. Trees infested with these insects were not at this time infested with other species. Not all of the laterals were killed, and the trees thus infested had a reasonable chance of recovery, as the terminal buds appeared healthy.

Recommendations

In spite of the unhealthy condition of the stand as presented, certain control measures are necessary. Two reasons are cited as imperative to improve the health and appearance of the stand: (1) It is necessary that trees infested with broods and which no longer have a chance of recovery be burned. This is especially urged for the control of the western pine beetle, D. brevicomis, since it may prevent the upbuilding of an epidemic. (2) Trees which are dead greatly increase the fire hazard and also give an unsightly appearance.

1. All trees which have faded for their entire length should be cut and burned, as they have no chance of recovery and probably contain broods of D. brevicomis.

2. Trees which have faded for 50 per cent of the crown should also be cut, as these will not recover and will probably be totally killed later by other insects.

3. Trees which have dead twigs and branches scattered throughout the crown should be left intact, as the living twigs and branches may not be attacked and there is a reasonable chance for recovery.

Incense Cedar Infestation

Much of the incense cedar extending along both sides of the Klamath River was found to be dying. Although the trees in every instance are young, the crowns in some cases are partially killed, in other cases the whole of the top is killed, while in still others the entire tree is killed. Several of the trees thus infested were cut and examined. One insect was found to be of outstanding importance, viz., a bark beetle, Phloeosinus sp., probably punctatus. This insect was found to be breeding in practically every portion of the trunk and branches on trees six inches or less in diameter. The damage was confined chiefly to the tops and branches, where the bark is thin. The damage to the middle and lower part of the trunk was not sufficient to kill the cambium.

It is apparent that the beetles are able to breed in the bark without killing the cambium, especially where the bark is thick. Evidence of several broods produced in a given area along the trunk is clear from the presence of large numbers of emergence holes and old larval galleries. Beneath this old work the phloem and cambium are green and have a healthy appearance.

The brood stage at the time of this examination was found to be full-grown larvae, most of which had already bored a short distance into the sapwood to pupate. In several instances broods of dead pupae were noted, evidently killed by cold weather. These had probably pupated last fall during the long dry period, and were killed by the sudden cold spell in December.

It is difficult to say at present what control measures are most feasible. Certainly all trees which have recently faded for the entire length should be destroyed. Trees only partially killed may recover, and these should not be cut.

FIGURE 1

Growth curve, Sequoia N.F., 1910-29
Av. for 11 green yellow pines

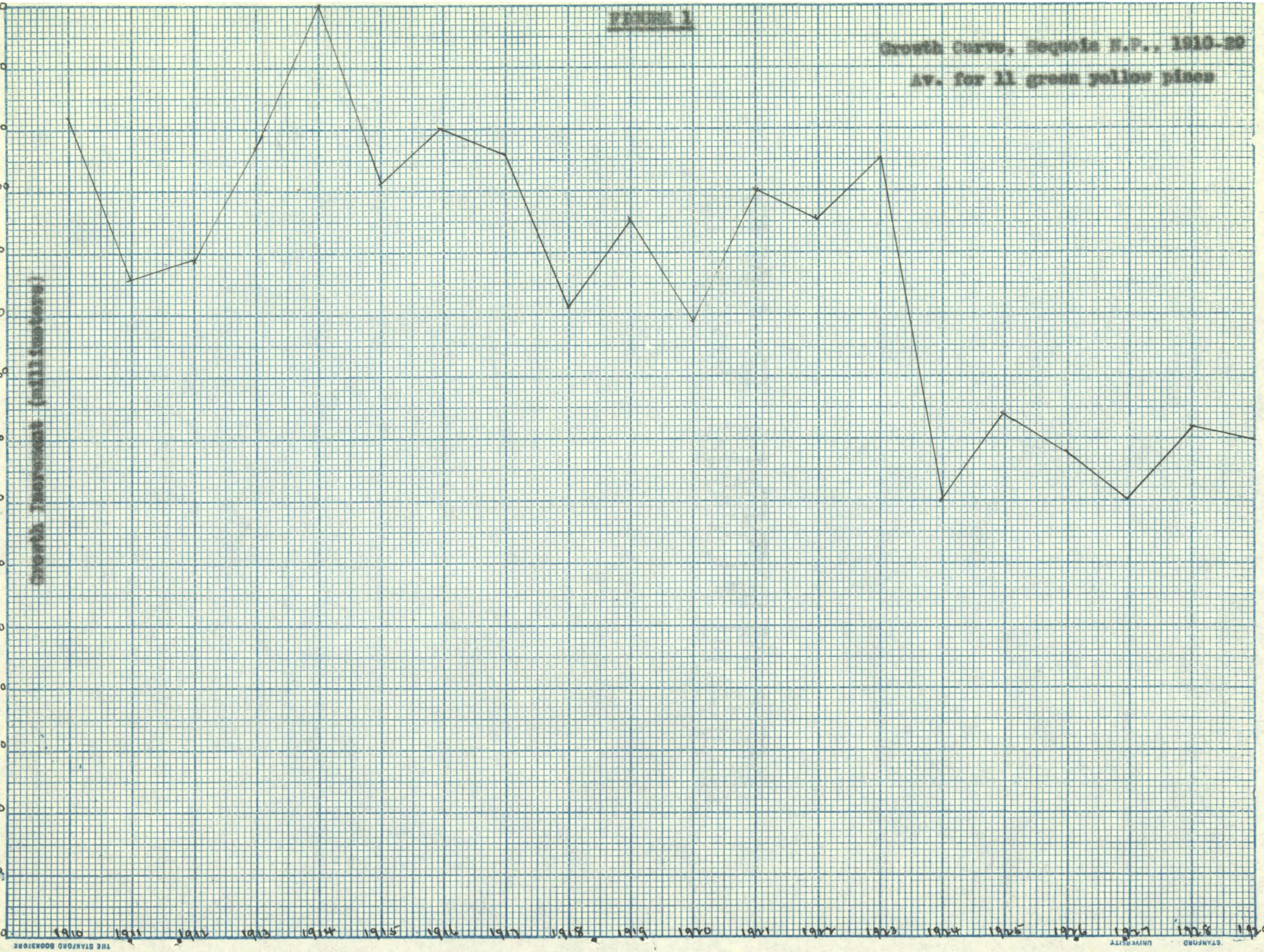

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FIGURE 2

Paradise Creek, Sequoia N.P.
Comparison of Growth Rates, 1921-29
_____ Av. 7 sel. fast-growing trees
_ _ _ _ " 6 " slow- " "
_ . _ . _ " growth of fast and sl.gr.
_ _ _ _ " " " 7 insect-killed trees